HIGHWAY RESEARCH REPORT

EFFECT OF BROOM TEXTURE ON MOTORCYCLE RIDEABILITY

INTERIM REPORT

STATE OF CALIFORNIA

BUSINESS AND TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

CA-HY-MR3126-8-72-32

Prepared in Cooperation with the U.S. Department of Transportation, Federal Highway Administration August, 1972

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16. ABSTRACT

A study was conducted to determine if the safety of the motorcyclist was impaired by the broom texture of the portland cement concrete roadway surface located on State Highway 50 near Sacramento. Three motorcycles were acquired for the test study. The smallest of the three was 250 cc's, the second was 500 cc's, and the third was a standard Highway Patrol bike. The evaluation was made by three experienced motorcyclists. The broom texture tested in this study did not present a hazardous riding condition to the motorcyclist. In general, the 250 cc bike was more sensitive to the surface texture than the other two bikes. This was even more evident with the addition of semi-knobby tires to both the front and back wheels.

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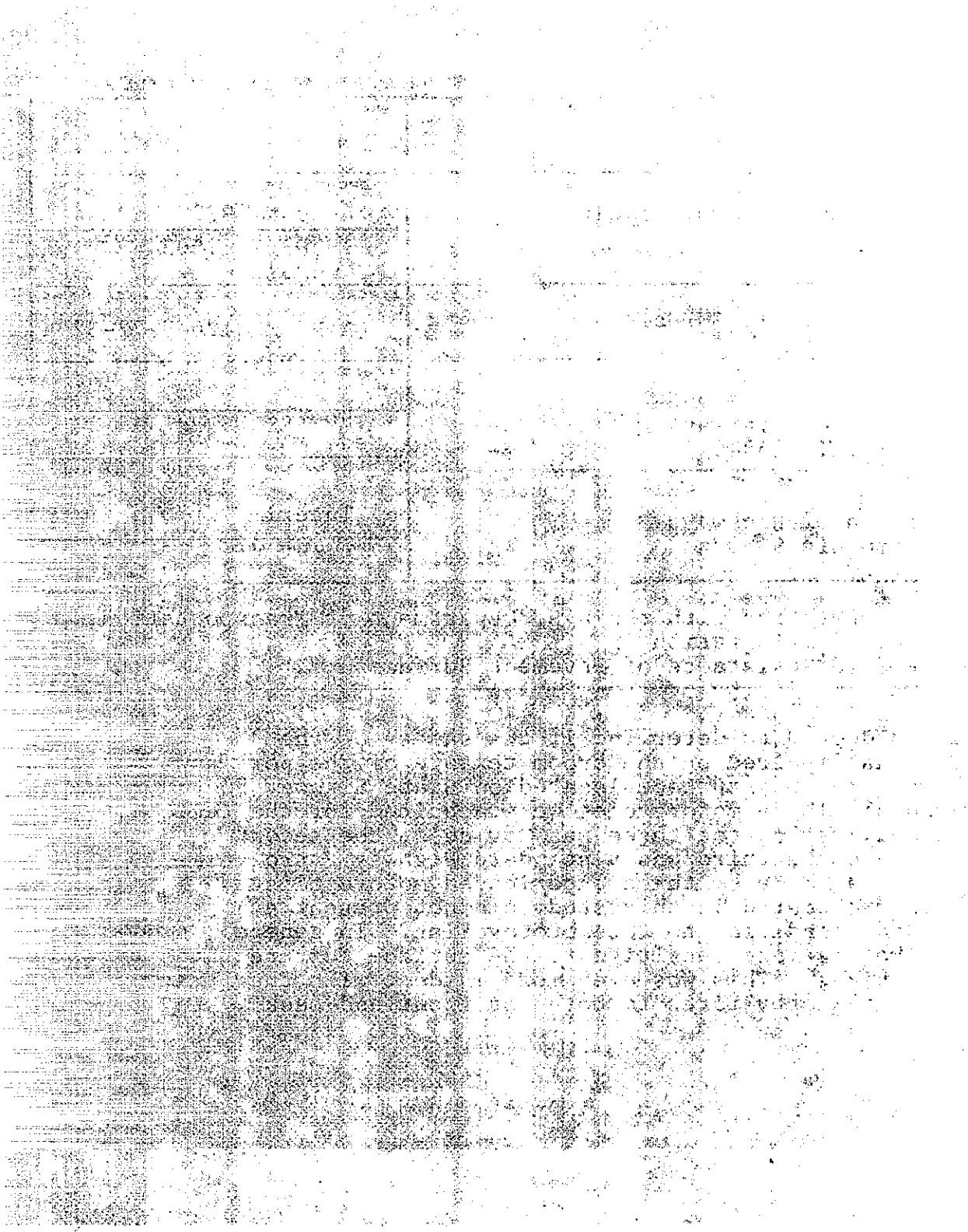


STATE OF CALIFORNIA—TRANSPORTATION AGENCY RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

August 1972

Interim Report
M&R No. 633126-8
Fed. No. B-3-1

Mr. R. J. Datel
State Highway Engineer

Dear Sir:

Submitted herewith is an interim report on research on skid resistance of pavement surfaces, entitled:

EFFECT OF BROOM TEXTURE ON
MOTORCYCLE RIDEABILITY

D. L. Spellman
Principal Investigator

J. H. Woodstrom
Co-Investigator

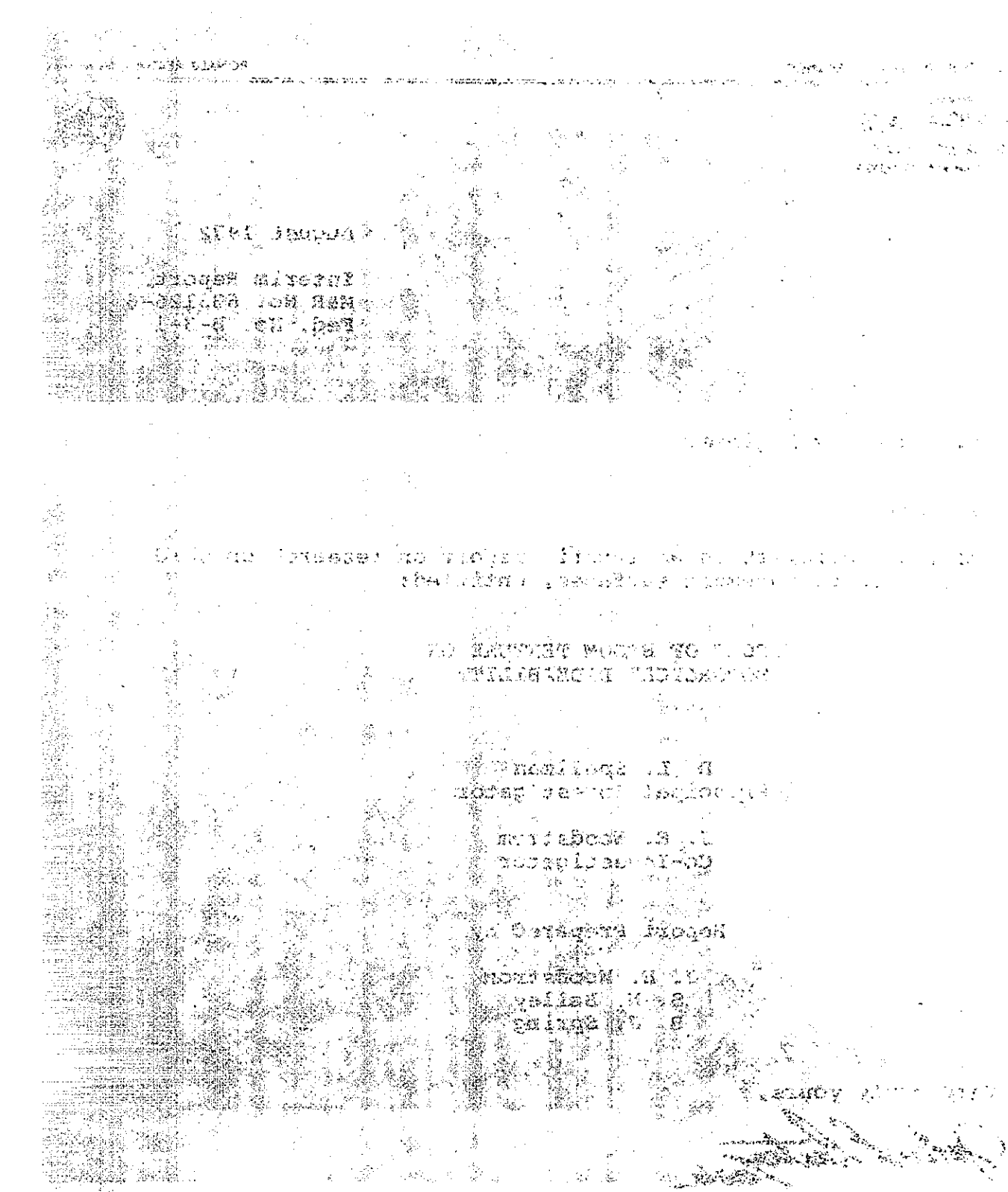
Report Prepared by

J. H. Woodstrom
S. N. Bailey
R. J. Spring

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

Attachment



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Assistance in conducting the project was also provided by Mr. P. E. Mason and E. L. Wilson of the Materials and Research Laboratory.

The project was performed in cooperation with the U.S. Department of Transportation, Federal Highway Administration, Agreement No. B-3-1.

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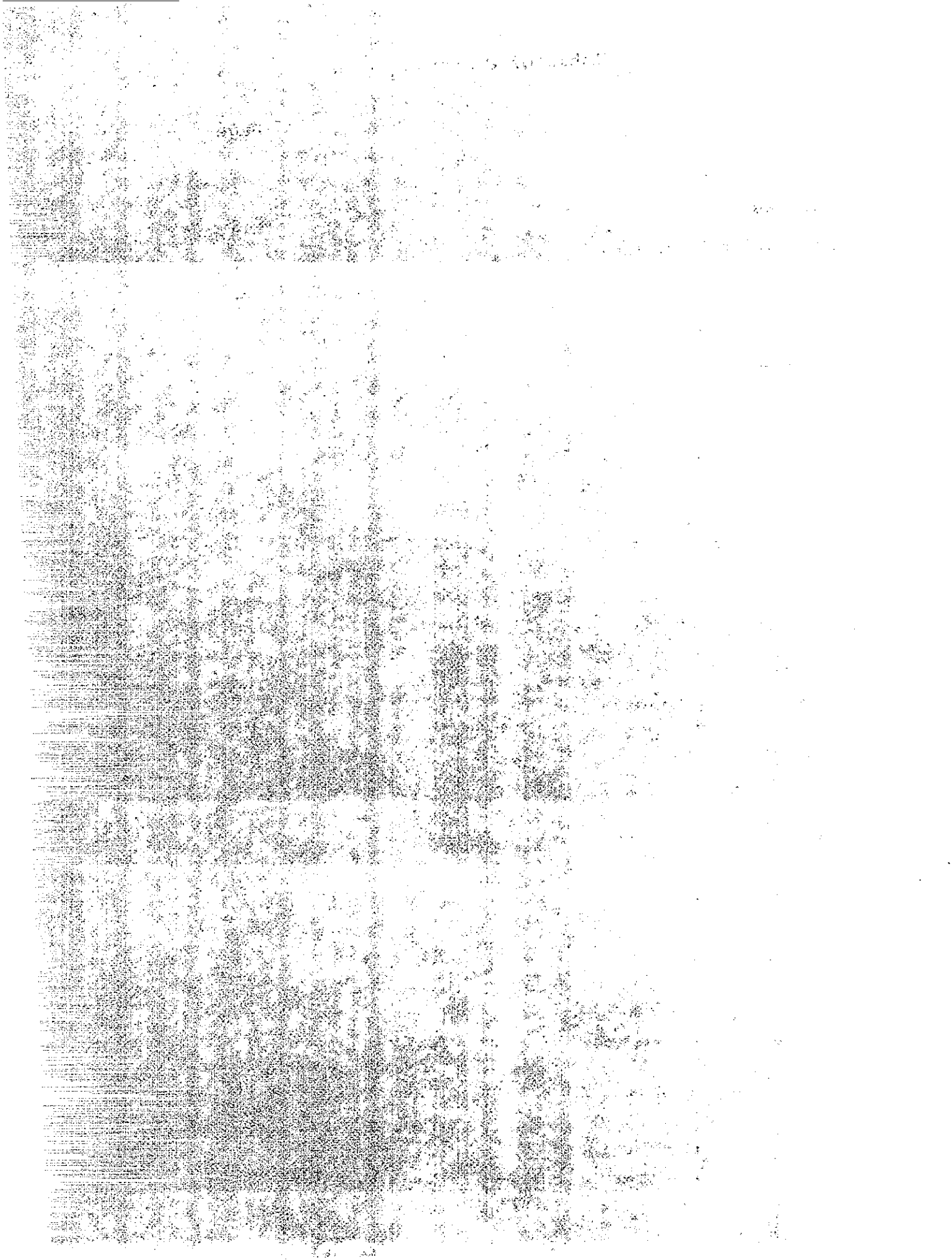


EFFECT OF BROOM TEXTURE ON MOTORCYCLE RIDEABILITY

Introduction

The problem of producing a PCC riding surface which provides a safe, durable skid resistance surface, has been an area of great concern to the highway engineers in recent years. In order to meet initial skid resistance requirements as well as maintain an adequate skid resistance coefficient over a long period of time, California has investigated several different types of PCC surface textures. As a result of the emphasis placed on this subject and the problems contractors have had in achieving specified friction levels on some projects, a large percentage of California pavements now receive a broomed texture. The striations thus formed are normally oriented in a longitudinal direction.

There is some variability in the characteristics of the longitudinal broomed texture in that (1) the alignment of the striations is not perfectly parallel with the roadway alignment, and at times the roadway surface presents a wavy appearance to drivers, and (2) striations may be deeper in some areas than they are in others. Generally, broomed texturing provides excellent initial skid resistance and good drainage in wet weather.

The heavy appearing texture produced by some brooming operations has prompted reports by motorcyclists that the pavement surface produces an uneasy feel while riding. The interaction between the tire and the pavement texture apparently causes minute lateral movements that can produce a startling sensation to operators of the smaller bikes. There have been no known accidents to cyclists that have been attributed to this condition; however, it was desired to obtain information as to the seriousness of the problem.

Shortly after a recently completed portion of U.S. Highway 50 in Sacramento was opened to public traffic, scattered complaints were received from motorcyclists on the effect of the surface texture on riding characteristics. A test site was selected on Contract 03-100844, between 65th Street and Mayhew Road, for study. From Station 84+00 to 109+00, which is in the

vicinity of Occidental Avenue O.C., the No. 4 (right hand) Eastbound lane was selected for concerted evaluation. This particular area had a heavy broom texture with deep wavy striations (see Figures 1 and 2) and represented a section of the more severe texture. In addition, a cursory evaluation was made of the portion of freeway from Watt Avenue to Stockton Boulevard in the outer lane, both directions.

Three motorcycles and three drivers were used in conducting the study. The motorcycles included a 250 cc, 500 cc, and a standard California Highway Patrol bike. The drivers selected for the study consisted of two experienced street riders and an experienced dirt rider, who has not ridden on freeways. It was felt that possibly the uneasy feeling expressed in the original complaints was due to a lack of experience in street or freeway riding and not as a result of the pavement texture. Therefore, it was decided to include a cyclist not experienced in freeway riding in order to compare his evaluation with that of the other two riders.

CONCLUSIONS

1. When related to other normal conditions, such as the transition from an AC shoulder to a PCC pavement, the effect of a crosswind or the effect of freeway traffic, the heavy broom texture studied in this report did not present a hazardous riding condition.

2. The 250 cc motorcycle, when equipped with semi-knobby tires, was most sensitive to the surface texture and a general "uneasiness" was expressed by riders.

These conclusions are necessarily limited to the findings obtained on one section of a recently opened freeway in which a specific mode of construction and texturing techniques were employed.

EVALUATION PROCEDURE

A series of skid resistance measurements were made on the broom texture prior to the motorcycle test. Skid measurements were made in the right lane every 250 feet in both the right and left wheel tracks using the California Portable Skid Tester (see layout in Figure 11), and the test results are shown in Table A. From these values, it can be seen that the pavement in general had excellent skid resistance characteristics. No significant difference could be established between the right and left wheel tracks.

In addition to the skid measurements, photographs of the surface texture were made at each skid test location in order to evaluate the texture depth. Typical conditions of surface texture are shown in Figures 1 and 2.

Observations

A 250 cc bike was selected as the smallest bike to be used for this study. Although the law in California now allows bikes of slightly smaller size, the 250 cc bike was selected as the most common "small" bike using freeways. A change in the law has been proposed to effectively limit the size of motorcycle to 250 cc minimum displacement. A 500 cc bike was selected as a medium size, and a fully equipped California Highway Patrol 1200 cc bike, as the largest (see Figures 3 through 8). All three of the motorcycles used in this study had moderate mileage and were in reasonably good condition.

In addition to the three sizes of motorcycles with standard street tires, evaluations were made with the 250 cc and 500 cc bikes equipped with semi-knobby tires on both the front and rear wheels (see Figures 9 and 10).

The three test drivers consisted of a uniformed California Highway Patrolman, a nonuniformed employee of the California Highway Patrol, and an employee of the Materials and Research Department. The latter was not experienced in freeway riding, but had considerable experience in dirt, or off-pavement riding.

The three riders were of different size and stature. The uniformed Highway Patrolman was 6'0" in height and weighed 200 pounds. The second Highway Patrol employee was 5'7" in height and weighed 155 lbs. The third rider was 6'1" and weighed 180 lbs. All three of the cyclists rode the 250 cc

and 500 cc bikes, but only the experienced street riders participated in the evaluation using the Highway Patrol bike.

Evaluation of the 1/2-mile test section was made at speeds of about 50 mph and 60 mph.

Three specific courses were set up so as to have the different riders evaluating the same area. Course 1 was a straight run along the right wheel track approximately 2'6" in from the right edge of the pavement. Course 2 was a straight run down the left wheel track approximately 8'6" from the right edge of the pavement. Course 3 was a curved run which required the rider to change from the left wheel track to the right wheel track, and back again two times during the 1/2-mile course (see Figure 12). This weaving action was designed to simulate lane changing in traffic. It was felt that the weaving action might create greater effect on the rideability of the motorcycles than the straight runs.

After running each course at speeds of about 50± mph and 60± mph with "standard" tires, the 250 cc and 500 cc bikes were equipped with semi-knobby tires both front and rear.

Courses 1 and 2 were run with these two bikes at both the 50 and 60 mph speed ranges, and Course 3 run at the lower (50± mph) speed range only.

After each run, the motorcyclists were asked for comments relating to such items as the overall feel of the roadway, steering problems, front wheel wobble, difficulty in controlling the bike, corrective measures if taken to adjust for riding surface, and if they limited speed for any reason.

In addition to the normal runs through the test section, the three motorcyclists drove over an additional 4-mile section of the freeway in both the eastbound and westbound directions. This additional run was used to evaluate the test section with respect to the entire freeway. For this purpose only one circuit was made with each bike and there was no exchange of riders. All of the cyclists were in agreement that there were no sections of the 4-mile run which could be considered a problem area with respect to being dangerous. However, the cyclist riding the 250 cc machine did notice two locations when some sensitivity to the texture could be felt. He did not feel that the condition was serious. The texture at these two locations was no different in appearance than the texture of the test location.

It was also noted by one of the cyclists that the most severe movement of the bike occurred when he passed over the joint between the asphalt shoulder and the pavement.

DISCUSSION

The data collected from questioning the riders was evaluated for each of the three bike sizes. The motorcyclists were usually in agreement as to their comments concerning the roadway.

The difference in the two speed runs of 50 mph and 60 mph had little if any effect on increasing the feeling of the roadway.

The weaving from one wheel track to the other presented no problems for any of the cyclists. None of the riders expressed any problems with steering using the standard street tires; however, one rider expressed feeling a slight effect due to the semi-knobby tires on the 500 cc machine.

There was some slight oscillation with the semi-knobby tires on the 500 cc bike, and a moderate amount with the 250 cc bike. Although this oscillation was more apparent using the 250 cc bike, it presented no problems in controlling the machine at the test speeds.

Generally speaking, the semi-knobby tires resulted in a somewhat rougher ride on this broom textured pavement; however, this would be expected on any type of PCC pavement surface.

TABLE A

Test No.	Station Location	Coefficient of Friction Left Wheel Track	Right Wheel Track
1	85+25	37	37
2	87+75	39	38
3	90+25	36	40
4	92+75	37	35
5	95+25	36	37
6	97+75	36	34
7	100+25	38	36
8	102+75	36	36
9	105+25	36	37
10	107+75	37	37

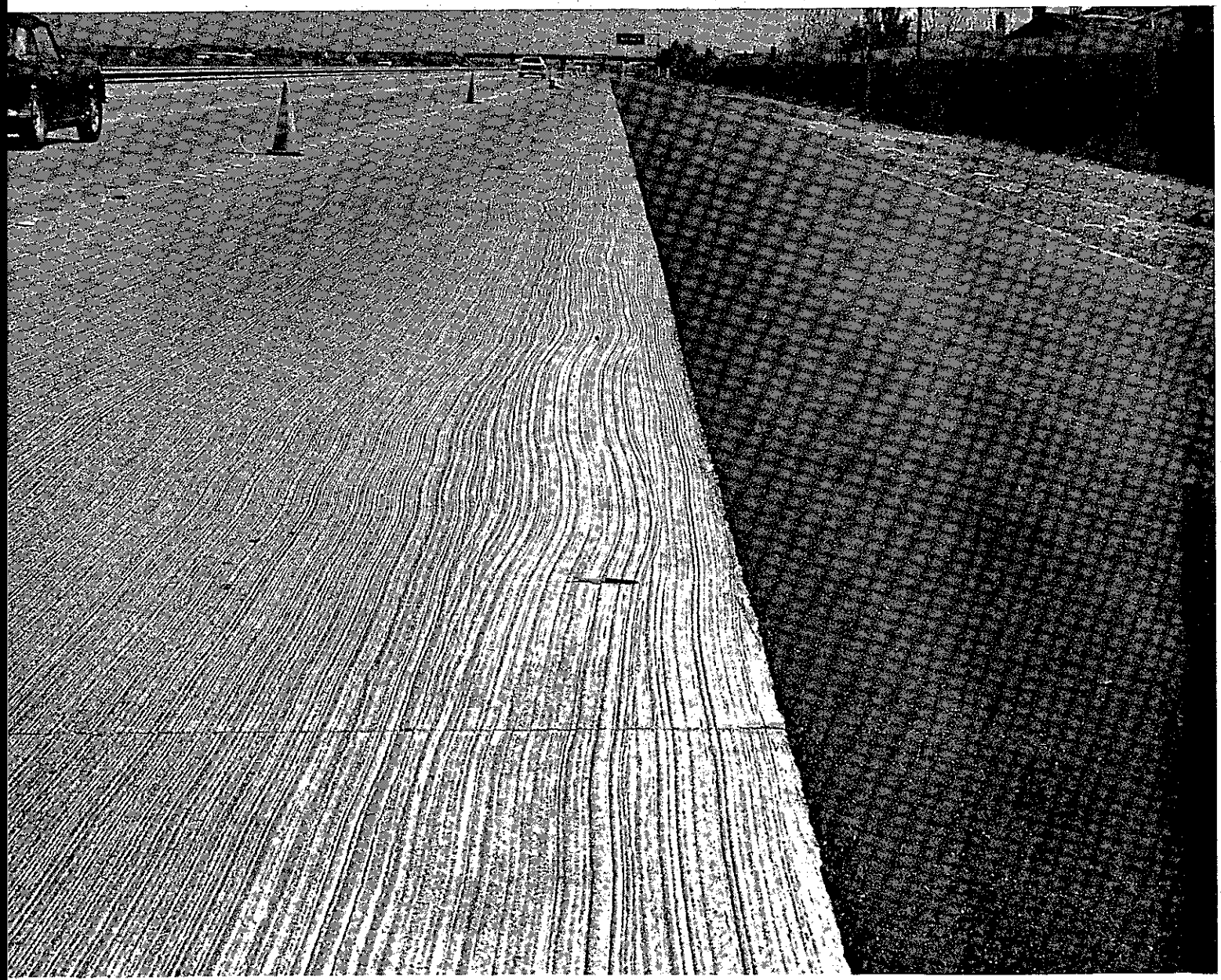


Figure 1. Typical condition of surface texture

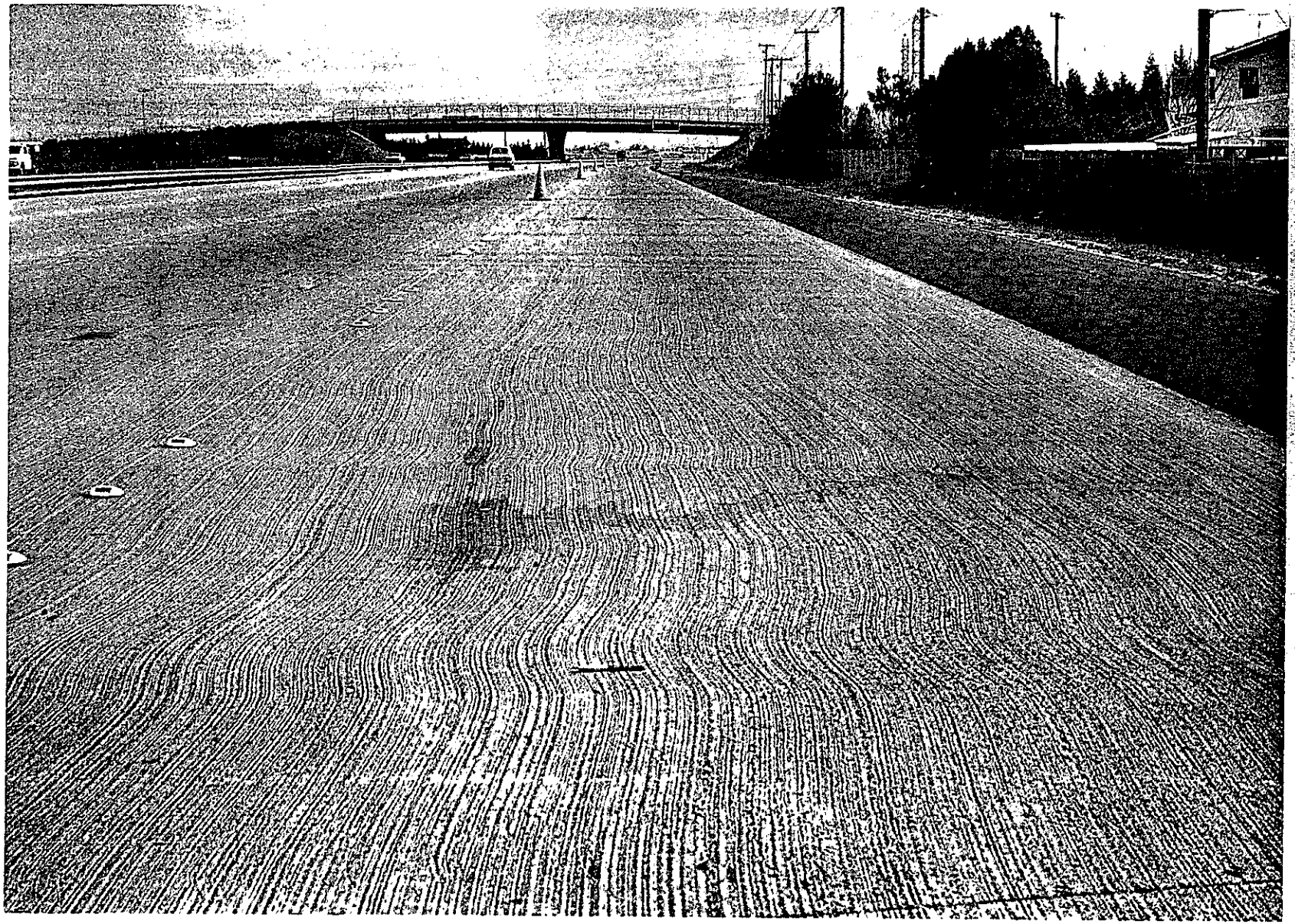


Figure 2. Typical condition of surface texture

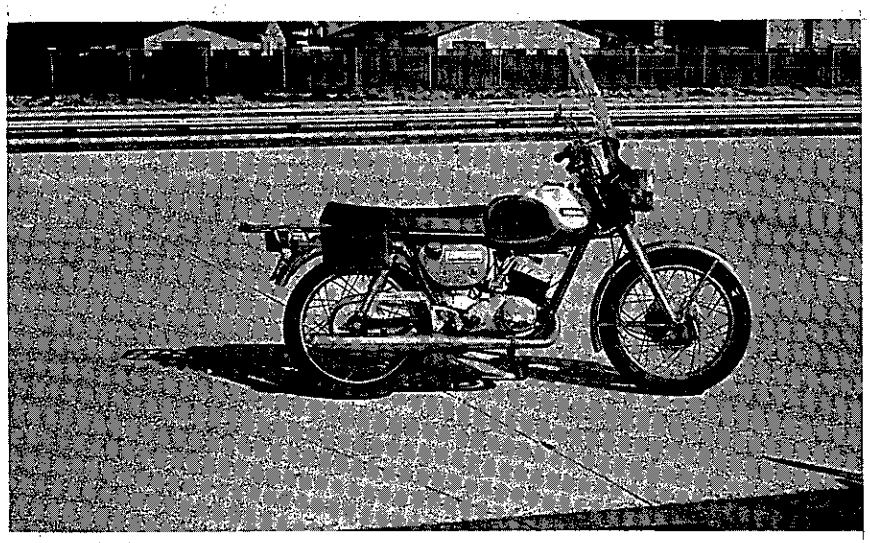


Figure 3. 250 cc Bike

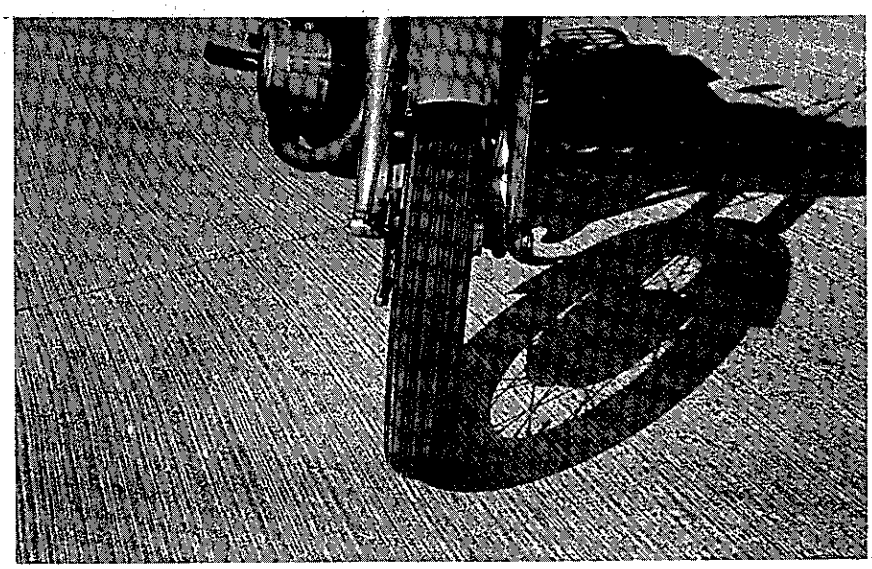


Figure 4. 250 cc Bike with Standard Tire

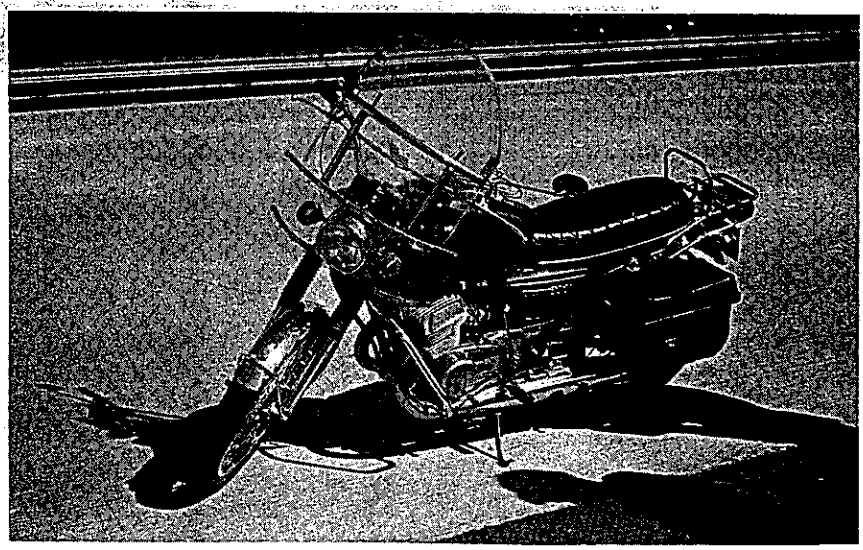


Figure 5. 500 cc Bike

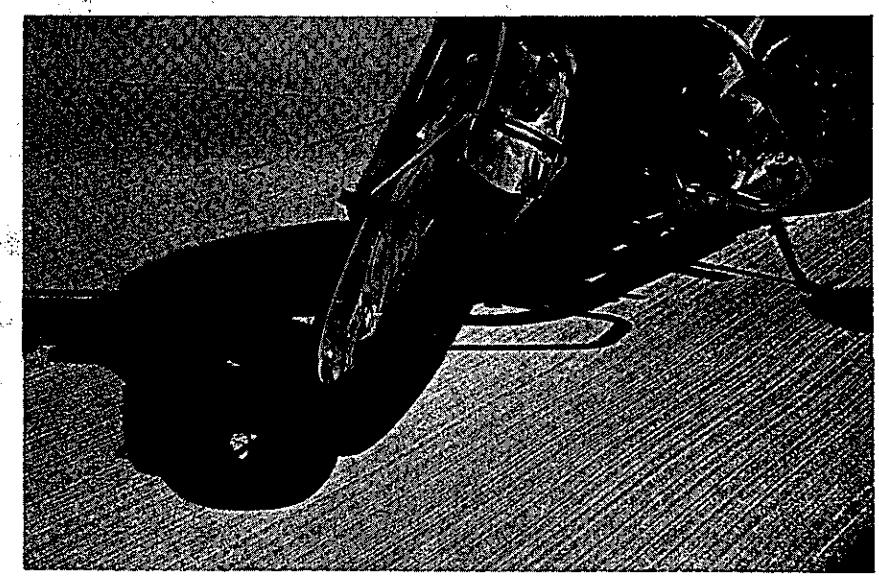


Figure 6. 500 cc Bike with Standard Tire

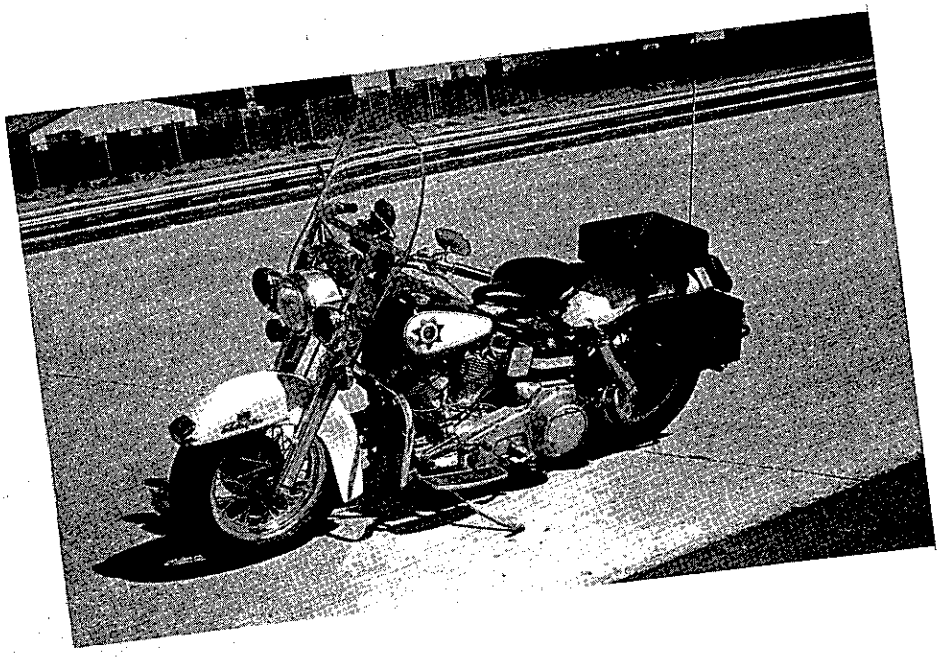


Figure 7. Highway Patrol Bike

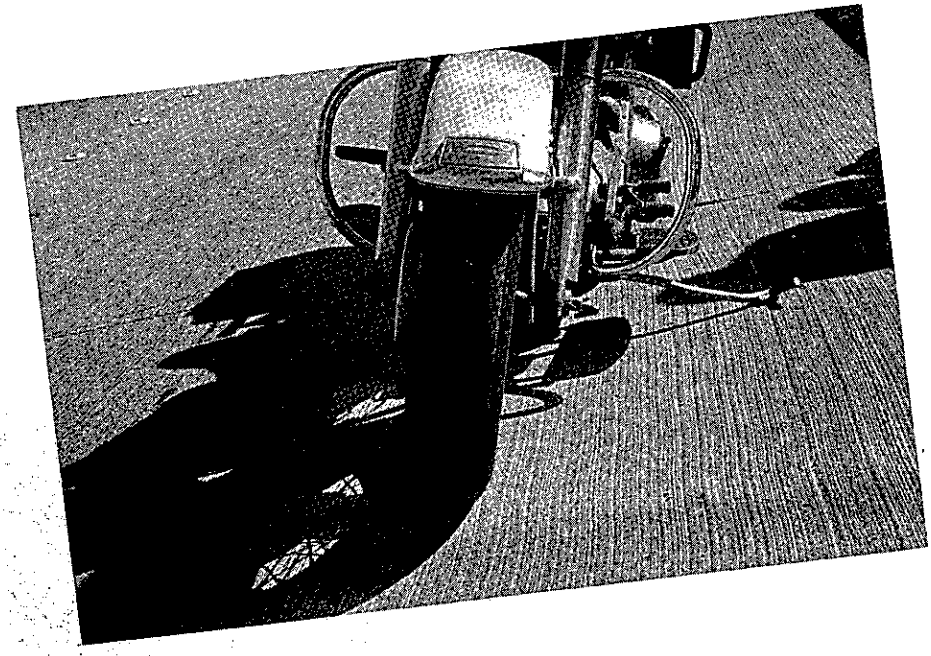


Figure 8. Highway Patrol Bike with Standard Tire

Figure 9. 500 cc Bike with Semi-knobby Tires

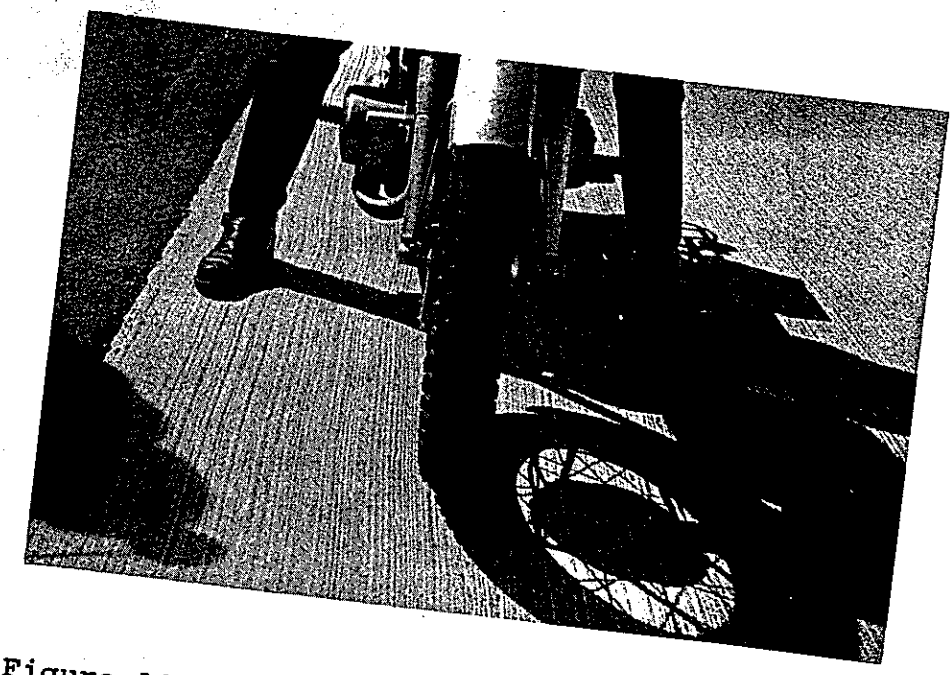
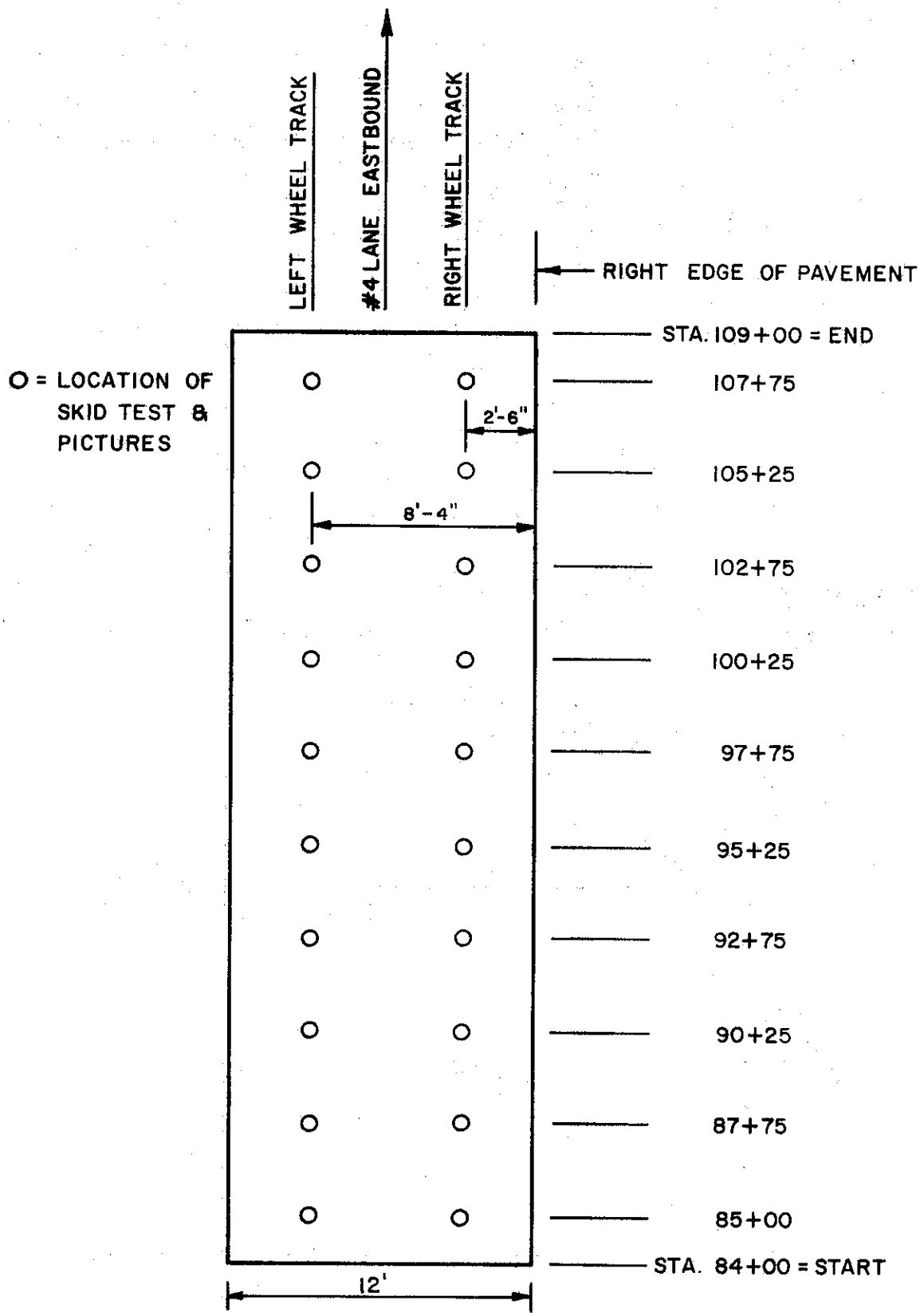


Figure 10. 250 cc Bike with Semi-knobby Tires

Figure 11



TEST SECTION

Figure 12